

XV.—*Size in the Avian Order Tubinares.* By J. T. NICHOLS, American Museum of Natural History, New York City.

(Text-figure 4.)

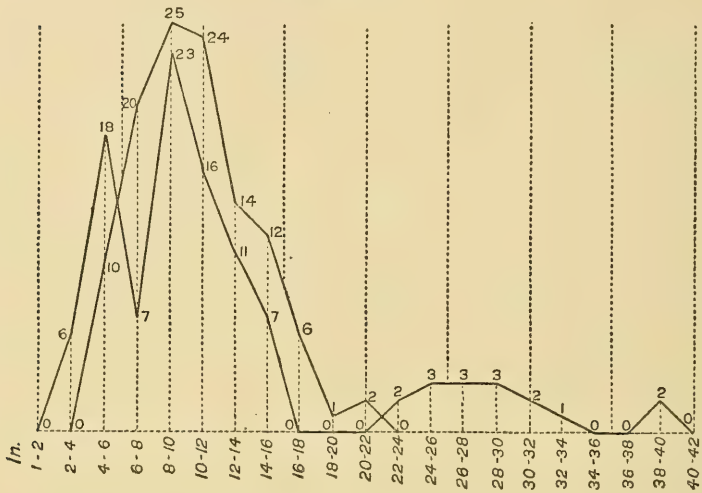
It is believed that the very great range in size among the members of the Avian order Tubinares, consisting of pelagic birds of more or less similar habits, and particularly numerous in the southern hemisphere, is due to intra-ordinal competition in absence of extra-ordinal competition.

Birds of this group feed off shore on fish, other marine life, and flotsam and jetsam, which they obtain at the surface. An exception, the genus *Pelecanoides*, which has acquired the diving habits and general character of the Alcidæ of the north, and therefore does not form so good a unit with other members of the order, has been excluded from the present discussion. To compare the sizes of the remaining species, the British Museum Catalogue, 1896, has been referred to, and the total length minus the tail has been used. Counting the length of the tail-feathers would give an erroneous idea in the smaller species, the comparative size of which would be greatly changed by the length or shortness of this member. Measurements thus obtained have been divided into groups with a one inch radius, and plotted in a line the height of which shows the number of species of the different sizes (fig. 4). For purposes of comparison a similar line plotted for the Gull-Tern order Longipennes rises abruptly to a single peak and falls almost as abruptly, but that of the Tubinares is much more extensive and shows at least three significant peaks, or predominant sizes—that of the small Mother-Carey's Chickens, that of the medium-sized Shearwaters, Fulmars, etc., and that of the large Albatrosses.

The Tubinares are pelagic birds *par excellence*, and almost all the aerial pelagic birds of the southern hemisphere below the Tropic are Tubinares. To one familiar with their breeding and feeding habits, it is perfectly obvious that the great range in size relieves pressure of competition. The small

Wilson's Petrel or Mother-Carey's Chicken, the medium-sized Cape Pigeon, and the large Albatross collect at one time to partake of the scraps from a ship, and the smaller birds are satisfied with crumbs left by the larger ones. Resorting from vast stretches of sea to nest on islands, as the different species must, the smaller ones seek the protection

Text-fig. 4.



The longer line extending the length of the diagram shows the variation in size in the Tubinares, the shorter line rising to one peak, that in the Longipennes or Gavix.

of necessarily limited holes and crevices; the larger, not needing protection, nest in the open. If all were approximately the same size, each would tend to crowd the other.

The case in the largely northern Longipennes is the reverse. Instead of being especially adapted to one feeding environment, these are decidedly all-round birds, at home everywhere. Some species are no less truly pelagic than the Tubinares, others live inland, where they feed on insects or even follow the plough. Their breeding range is much more extensive, inland or on the coast, wherever suitable opportunity offers. Such being the case, they compete among themselves much less, but meet with more

outside competition, with Alcidæ, shore-birds, land-birds, etc. It is difficult to believe that a Gull of the size of an Albatross would find a place inland or shore-wise, available food being preëmpted by vultures, mammals, etc., and there being few available safe nesting-places for birds even as large and clumsy as a Pelican. The only chance such a form would have to pick up a living, would be over wide stretches of sea. As one would expect, the Tubinares, not the Longipennes, have filled this sea gap, the sea being their especial field.

At the other end of the line, inland Terns, if of much smaller size, would meet an increasingly strong competition for food with the host of smaller land-birds. For instance, a minute species with habits similar to those of the Black Tern would come in direct competition with Swallows and other insectivores. Small pelagic species would have difficulty in finding proper nesting sites, partly from the abundance of the Alcidæ in the north. It is interesting that the small, abundant Wilson's Petrel, nesting in the southern hemisphere in summer, crosses to the northern hemisphere and helps fill the hiatus left over the north Atlantic by Gulls, Phalaropes and Alcidæ when these are necessarily ashore, breeding in the northern summer.

The presupposed case would be a comparative unity in the size of the Longipennes, which the facts seem to show.

In conclusion, great variation in size and predominance of certain periodic sizes is a definite character of the order Tubinares, which may be explained by intra-ordinal competition.

---

XVI.—*A Flock of Tubinares.* By ROBERT CUSHMAN MURPHY, Ph.B., Brooklyn Museum, New York City.

(Text-figure 5.)

THE accompanying photograph of a flock of Tubinares was taken by the writer on the 4th of November, 1912, in latitude 32° 28' S., longitude 45° 42' W., in the south Atlantic